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PRODUCTION OF EXPLOSIVES IN THE UNITED STATES

DURING THE CALENDAR YEAR 1918

WITH NOTES ON COAL-MINE ACCIDENTS DUE TO EXPLOSIVES
AND LIST OF PERMISSIBLE EXPLOSIVES
TESTED PRIOR TO MARCH 31, 1919

COMPILED BY

ALBERT H. FAY

WASHINGTON
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PRODUCTION AND DISTRIBUTION OF EXPLOSIVES IN THE UNITED STATES DURING THE CALENDAR YEAR 1918.

Compiled by ALBERT H. FAY.

INTRODUCTION.

The total production, excluding the amount exported, of explosives in the United States during the calendar year 1918, according to figures that the Bureau of Mines has received from manufacturers, was 499,224,660 pounds (249,612 short tons) as compared with 582,475,327 pounds (291,238 short tons) in 1917.

The production for 1918 is segregated as follows: Black blasting powder, 246,663,350 pounds; "high" explosives other than permissible explosives, 206,516,077 pounds; and permissible explosives, 46,045,233 pounds. These figures represent a decrease of 30,455,175 pounds of black powder, 55,800,003 pounds of high explosives, and an increase of 3,004,511 pounds of permissible explosives as compared with figures for 1917.

The decrease in the amount of black blasting powder used in coal mining was about 20,000,000 pounds; this decrease was offset largely by an increase of about 3,000,000 pounds of high explosives and 4,000,000 pounds of permissible explosives. In metal mining there was a decrease in the amount of all classes of explosives used, largely because of war conditions preventing the average amount of development work during the year and also because of the closing of many of the smaller mines, especially gold mines, and the general decrease in mining during the last two months of the year.

CLASSIFICATION OF EXPLOSIVES.

The production figures tabulated herein are classified as follows:

1. *Black blasting powder.*—All black powder with sodium or potassium nitrate as a constituent is here classified as black blasting powder.

2. *High explosives.*—Dynamite and all other high explosives of various trade names and compositions, except permissible explosives, are put in this class.

3. *Permissible explosives.*—In this class are included ammonium nitrate explosives, hydrated explosives, organic nitrate explosives, and certain nitroglycerin explosives containing an excess of free water or carbon. All permissible explosives have passed certain tests

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of the Bureau of Mines and are not to be regarded as permissible unless used in the manner specified by the bureau.[a]

ACKNOWLEDGMENTS.

The Bureau of Mines takes this opportunity to express its appreciation of the aid rendered by the manufacturers in furnishing the data compiled and to Mr. C. Stewart Comeaux, secretary of the Institute of the Makers of Explosives. The author acknowledges the assistance rendered by W. W. Adams and Miss L. S. Gerry in compiling the various tables.

SCOPE OF STATISTICS.

Table 1 gives the quantity of explosives used in each State during the calendar years 1917 and 1918. Tables 2, 3, and 4 present the total production and uses, by groups of States, of black blasting powder, high explosives, and permissible explosives, the States being grouped so as to include regions where the general conditions of mining are roughly similar.

Table 5 shows the rapid increase in the production and sale of permissible explosives for use in coal mines. In 1902 only 11,300 pounds of short-flame or "safety" explosives were used in coal mining, whereas in 1918 the quantity of permissible explosives so used was 37,262,915 pounds.

The quantity of permissible explosives used in the United States is larger than that of the corresponding explosives in a number of foreign countries. In 1912 it represented about 5 per cent of the total quantity of explosives produced, and in 1918, 9.2 per cent. The total amount of explosives used for the production of coal in 1918 was 284,852,538 pounds, of which 13 per cent was of the permissible class.

Table 6 gives the quantities of permissible explosives used for coal mining in the various coal fields. Table 10 shows that in 1918 about 81 per cent of the permissible explosives manufactured were used for coal mining. The remaining 19 per cent is reported under the items "Other Mining" "Railway and Construction Work," and "All Other Purposes," in Tables 4 and 10.

The figures for 1918 represent the reports of 28 manufacturers who operated their various plants during the year. Many of the manufacturers operated more than one plant, so that their number does not necessarily indicate the total number of plants. The number of manufacturers reporting sales of black powder was 22; of high explosives, 20; and of permissible explosives, 14. A number of other companies reported their plants as idle during the year, or as having been sold to other manufacturers.

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[a] Hall, Clarence, Snelling, W. O., and Howell, S. P., Investigations of explosives used in coal mines, with a chapter on the natural gas used at Pittsburgh, by G. A. Burrell, and an introduction by C. E. Munroe: Bull. 15, Bureau of Mines, 1912, 197 pp. Hall, Clarence, and Howell, S. P., Tests of permissible explosives: Bull. 66, Bureau of Mines, 1913, 313 pp.

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The reports of manufacturers of fireworks and of ammunition are not included, inasmuch as the majority of these manufacturers purchase their explosives from one or more of the manufacturers of explosives whose production has been included in the tabulations presented herein.

PRODUCTION AND DISTRIBUTION OF EXPLOSIVES.

The production and use of explosives in the United States are given in detail in Tables 1 to 6, following.

TABLE 1.—*Amount of explosives (excluding exports) manufactured in the United States and used in the various States during the calendar years 1917 and 1918.*

State.	1917			1918		
	Black blasting powder.	High explosives other than permissible.	Permissible explosives.	Black blasting powder.	High explosives other than permissible.	Permissible explosives.
	Kegs.	*Pounds.*	*Pounds.*	*Kegs.*	*Pounds.*	*Pounds.*
Alabama	260,017	6,319,574	4,322,120	173,481	5,948,814	4,434,380
Alaska	86,222	5,083,485	63,700	178	2,213,600	41,200
Arizona	31,510	14,992,697	130,300	18,833	13,124,525	15,600
Arkansas	140,081	1,400,070	69,300	105,768	826,461	103,400
California	124,048	13,617,199	20,450	43,538	8,517,684	1,600
Colorado	113,583	7,700,225	994,005	92,975	4,902,915	903,550
Connecticut	752	632,425	750	317	420,500	.....
Delaware	186	54,750	.....	66	50,075	1,000
Florida	1,714	1,717,350	760	407	1,233,100	32,625
Georgia	41,184	1,002,789	404,540	18,891	752,200	350
Idaho	4,471	5,362,200	.....	5,857	2,874,630	4,550
Illinois	2,020,412	5,644,191	2,379,350	1,998,235	3,693,422	2,664,400
Indiana	1,021,329	2,161,119	242,525	1,095,128	1,471,302	356,596
Iowa	444,276	1,996,682	2,700	344,684	1,427,080	975
Kansas	550,705	4,551,628	221,556	502,095	5,220,869	59,152
Kentucky	545,401	2,169,169	1,042,190	600,791	1,812,676	1,142,620
Louisiana	9	1,200,658	62,000	367	691,640	72,474
Maine	2,313	531,425	.....	1,180	324,350	.....
Maryland [a]	47,043	1,565,975	50,075	45,787	1,126,770	89,300
Massachusetts	2,977	594,115	13,450	1,337	387,250	.....
Michigan	34,894	29,099,611	155,100	20,907	24,994,152	23,600
Minnesota	173,926	11,694,029	.....	179,045	9,941,860	.....
Mississippi	2,260	438,825	500	48	299,500	1,150
Missouri	227,080	20,939,965	240,470	219,571	9,120,244	168,904
Montana	138,759	7,774,421	51,050	112,033	8,216,874	51,100
Nebraska	5,002	162,240	1,997	2,314	88,710	.....
Nevada	6,450	7,693,795	.....	11,507	4,733,025	500
New Hampshire	323	112,900	500	189	136,425	.....
New Jersey	2,181	2,434,467	950	1,956	2,227,130	16,600
New Mexico	30,729	3,741,454	730,375	7,913	2,576,310	775,250
New York	21,658	8,013,247	1,119,225	14,551	6,016,836	466,150
North Carolina	23,922	1,816,720	1,050	12,283	1,094,925	900
North Dakota	32,831	345,480	100	21,343	286,525	3,425
Ohio	638,519	7,108,617	82,744	597,232	6,521,085	35,869
Oklahoma	200,609	9,044,506	566,791	196,083	8,955,527	1,102,775
Oregon	18,171	3,089,516	1,550	22,902	2,816,684	1,150
Pennsylvania	2,504,344	35,831,445	17,521,706	2,211,094	34,797,146	20,061,997
Rhode Island	283	65,275	.....	172	80,550	.....
South Carolina	7,541	491,000	2,640	1,523	411,925	.....
South Dakota	2,699	1,736,930	.....	2,121	1,199,535	.....
Tennessee	183,151	3,336,285	252,002	157,435	2,487,005	598,089
Texas	69,361	1,766,550	69,100	44,380	1,206,020	28,200
Utah	30,135	4,661,250	4,652,950	27,211	3,610,556	4,430,820
Vermont	7,485	338,250	2,000	2,297	180,075	.....
Virginia	148,467	3,289,350	425,775	113,837	2,589,058	499,025
Washington	39,108	6,031,522	388,100	49,647	5,934,194	427,800
West Virginia	932,282	4,795,859	6,256,176	656,467	3,511,835	6,812,657
Wisconsin	5,073	7,256,455	.....	2,380	5,045,653	25,000
Wyoming	159,265	908,390	498,100	128,178	416,850	590,500
Total	[b] 11,084,741	262,316,080	43,040,722	[b] 9,866,534	206,516,077	46,045,233
	[c] 277,118,525	.....	.....	[c] 246,663,350	.....	.....
Grand total (pounds).	582,475,327			499,224,660		

[a] Includes District of Columbia. [b] Kegs of 25 pounds each. [c] Pounds.

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TABLE 2.—*Amount of black blasting powder used in the United States during 1917 and 1918, classified by use.*

[Kegs of 25 pounds each.]

Groups of States.	Black blasting powder, 1917.				Black blasting powder, 1918.			
	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.
	Kegs.	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont	.....	429	5	12,947	.....	242	75	4,858
Group 2. Connecticut, New Jersey, and New York	.....	4,828	1,320	18,443	.....	3,056	763	13,005
Group 3. Delaware, District of Columbia, Maryland, and Virginia	175,829	1,820	7,903	10,144	143,028	1,747	4,875	10,040
Pennsylvania	2,193,020	8,160	52,845	250,319	1,902,309	4,705	34,689	269,391
West Virginia	867,673	4,852	32,334	27,423	614,841	2,400	9,116	30,110
Group 4. Florida, Georgia, North Carolina, and South Carolina	7,595	6,698	46,803	13,265	1,095	5,112	19,538	7,359
Group 5. Indiana and Kentucky	1,451,976	12,071	17,651	85,032	1,605,775	7,330	10,811	72,003
Illinois	1,964,578	8,011	1,618	46,205	1,950,587	9,014	153	38,481
Ohio	565,950	26,599	8,987	36,983	519,006	18,327	4,045	55,854
Group 6. Alabama, Mississippi, and Tennessee	372,425	19,508	27,831	25,664	279,771	9,836	22,556	18,801
Group 7. Michigan, Minnesota, and Wisconsin	23,904	181,742	1,712	6,535	13,377	180,826	681	7,448
Group 8. Iowa, Kansas, Missouri, and Nebraska	1,120,206	22,142	20,606	64,109	1,009,672	9,390	8,057	41,545
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	358,105	8,253	17,807	25,895	309,729	8,642	10,228	17,999
Group 10. Montana, North Dakota, South Dakota, and Wyoming	209,576	23,221	51,967	48,790	206,104	10,380	9,023	38,168
Group 11. Colorado, New Mexico, and Utah	94,968	20,549	15,295	43,635	72,935	10,031	10,344	34,789
Group 12. Alaska, Idaho, Oregon, and Washington	24,027	680	104,521	18,744	20,633	1,374	37,909	18,668
Group 13. Arizona, California, and Nevada	180	28,636	107,687	25,505	.....	15,406	36,397	22,075
Total (kegs)	9,430,012	378,199	516,892	759,638	8,648,862	297,818	219,260	700,594
Grand total (kegs)	**11,084,741**				**9,866,534**			

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TABLE 3.—*Amount of high explosives used in the United States during 1917 and 1918, classified by use.*

Groups of States.	High explosives other than permissible explosives, 1917.				High explosives other than permissible explosives, 1918.			
	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont	.....	101,650	253,699	1,286,616	.....	74,050	172,675	861,925
Group 2. Connecticut, New Jersey, and New York	.....	4,633,300	1,621,411	4,825,428	.....	4,241,350	869,469	3,553,647
Group 3. Delaware, District of Columbia, Maryland, and Virginia	649,250	670,500	709,025	2,881,300	633,925	446,300	537,500	2,148,178
Pennsylvania	18,406,464	646,346	2,030,572	14,748,063	19,568,436	452,970	1,355,697	13,420,043
West Virginia	1,162,277	63,825	1,030,899	2,538,858	971,795	7,050	463,017	2,069,973
Group 4. Florida, Georgia, North Carolina, and South Carolina	147,400	706,735	1,595,970	2,577,754	29,200	722,775	951,405	1,788,770
Group 5. Indiana and Kentucky	707,591	182,425	880,828	2,559,444	896,480	174,375	622,350	1,590,773
Illinois	533,075	1,303,650	407,584	3,399,882	581,553	1,331,150	98,325	1,682,394
Ohio	448,681	342,300	347,073	5,970,563	855,501	261,692	496,552	4,907,340
Group 6. Alabama, Mississippi, and Tennessee	1,039,959	5,784,475	1,157,935	2,112,315	1,701,275	4,141,965	1,305,323	1,586,756
Group 7. Michigan, Minnesota, and Wisconsin	85,375	39,647,146	662,097	7,655,477	116,150	33,970,850	363,300	5,531,365
Group 8. Iowa, Kansas, Missouri, and Nebraska	2,761,275	19,927,340	885,900	4,076,000	3,534,428	9,328,112	535,067	2,459,296
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	424,015	7,979,394	893,757	4,114,618	532,965	8,462,225	575,229	2,109,229
Group 10. Montana, North Dakota, South Dakota, and Wyoming	752,975	8,032,678	630,410	1,349,158	1,095,760	7,569,980	78,834	1,375,210
Group 11. Colorado, New Mexico, and Utah	401,520	9,343,629	228,585	6,129,195	251,480	6,739,745	81,760	4,016,796
Group 12. Alaska, Idaho, Oregon, and Washington	742,950	7,149,095	3,566,770	8,107,908	599,125	4,326,500	2,031,645	6,881,838
Group 13. Arizona, California, and Nevada	.....	25,721,027	3,515,712	7,066,952	.....	20,115,787	1,543,393	4,716,054
Total (pounds)	28,262,807	132,235,515	20,418,227	81,399,531	31,368,073	102,366,876	12,081,541	60,699,587
Grand total (pounds)	**262,316,080**				**206,516,077**			

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TABLE 4.—*Amount of permissible explosives used in the United States during 1917 and 1918, classified by use.*

Groups of States.	Permissible explosives, 1917.				Permissible explosives, 1918.			
	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont	.....	500	.....	15,450	.....	.....	.....	.....
Group 2. Connecticut, New Jersey, and New York	.....	1,107,825	2,000	11,100	.....	465,650	500	16,600
Group 3. Delaware, District of Columbia, Maryland, and Virginia	380,825	19,250	.....	75,775	489,250	24,050	550	75,475
Pennsylvania	15,517,675	2,500	27,250	1,974,281	18,256,206	3,600	22,925	1,779,266
West Virginia	5,899,019	7,500	8,100	341,557	5,902,357	12,550	26,350	871,400
Group 4. Florida, Georgia, North Carolina, and South Carolina	50	800	.....	408,140	900	100	.....	32,875
Group 5. Indiana and Kentucky	1,181,115	7,400	1,000	95,200	1,335,716	10,500	.....	153,000
Illinois	2,213,500	90,500	5,400	69,950	2,609,300	42,700	.....	12,400
Ohio	6,948	4,500	2,000	69,296	13,806	5,500	.....	16,563
Group 6. Alabama, Mississippi, and Tennessee	4,296,640	173,200	9,260	95,522	4,692,616	250,930	15,630	74,443
Group 7. Michigan, Minnesota, and Wisconsin	50	137,400	.....	17,650	200	14,600	.....	33,800
Group 8. Iowa, Kansas, Missouri, and Nebraska	13,590	65,600	6,225	381,308	18,130	38,900	8,500	163,501
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	610,455	61,950	3,400	91,386	912,314	201,500	800	192,235
Group 10. Montana, North Dakota, South Dakota, and Wyoming	478,000	28,100	500	42,650	568,850	18,850	5,275	52,050
Group 11. Colorado, New Mexico, and Utah	1,945,180	4,188,650	21,050	222,450	2,053,670	3,427,950	60,350	567,650
Group 12. Alaska, Idaho, Oregon, and Washington	366,200	61,750	20,000	5,400	408,950	16,350	42,500	6,900
Group 13.—Arizona, California, and Nevada	1,150	144,800	.....	4,800	650	16,400	.....	650
Total (pounds)	32,910,397	6,102,225	106,185	3,921,915	37,262,915	4,550,130	183,380	4,048,808
Grand total (pounds)	**43,040,722**				**46,045,233**			

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TABLE 5.— *Yearly sales of short-flame explosives used in coal mines in the United States, 1901–1918.*

Year.	Quantity sold.	Year.	Quantity sold.
	Pounds.		*Pounds.*
1901	.....	1910	11,820,836
1902	11,300	1911	13,428,239
1903	288,661	1912	18,150,618
1904	608,270	1913	21,804,285
1905	1,031,300	1914	19,593,892
1906	1,533,575	1915	21,841,659
1907	2,095,244	1916	26,566,521
1908	2,108,610	1917	32,910,397
1909	8,942,857	1918	37,262,915

TABLE 6.—*Quantity of permissible explosives used in different coal fields in the United States, 1912–1918.*

Coal fields and regions.	1912	1913	1914	1915	1916	1917	1918
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1. Pennsylvania anthracite field.	2,177,172	3,294,225	4,380,635	5,037,050	5,219,032	7,298,925	7,654,250
2. Northern Appalachian region[a]	9,190,025	9,744,810	7,966,464	9,435,318	12,147,207	14,505,542	17,007,369
3. Southern Appalachian region.	3,995,485	4,481,975	3,510,013	3,447,964	4,386,757	5,287,755	5,764,886
4. Eastern interior field	751,005	2,058,075	1,364,450	1,631,775	1,949,925	2,403,600	2,873,846
5. Western interior field	440,825	377,625	411,937	433,010	422,425	624,045	930,444
6. Rocky Mountain region	1,473,129	1,634,575	1,796,750	1,710,992	2,244,275	2,423,180	2,622,520
7. Pacific coast region	122,977	213,000	163,643	145,550	196,900	367,350	409,600
Total	**18,150,618**	**21,804,285**	**19,593,892**	**21,841,659**	**26,566,521**	**32,910,397**	**37,262,915**

[a] Not including Pennsylvania anthracite field.

TABLE 7.—*Coal-mine fatalities due to explosives, 1911–1918.*

States.	1911	1912	1913	1914	1915	1916	1917	1918
Pennsylvania	94	85	79	97	88	96	62	56
West Virginia	3	8	8	5	6	3	6	14
Illinois	15	11	11	9	11	6	9	12
Ohio	3	5	6	2	3	5	4	8
Indiana, Michigan, and Kentucky	15	3	5	12	12	10	14	20
Alabama, Tennessee, Georgia, and North Carolina	6	6	2	2	10	3	3	5
Iowa, Kansas, and Missouri	4	14	6	4	13	9	2	7
Colorado, New Mexico, and Utah	3	1	7	4	.....	4	3	3
Maryland and Virginia	.....	10	2	.....	4	3	2	5
Montana, North Dakota, and Wyoming	4	2	4	4	3	2	2	1
Arkansas, Oklahoma, and Texas	11	1	5	4	5	1	4	4
Alaska, California, Idaho, Nevada, Oregon, and Washington	2	1	3	3	.....	4	.....	.....
Total, underground	**160**	**147**	**138**	**146**	**155**	**146**	**111**	**135**

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FATALITIES IN THE MINING INDUSTRY DUE TO EXPLOSIVES.

Tables 7, 8, and 9 present the number of fatalities from the use of explosives in the mining industry. Table 7 gives all of the explosives fatalities at coal mines, and Table 8 those at bituminous mines alone. The latter table shows a decrease in the number of fatalities, as well as in the percentage and fatality rates since 1903. Inasmuch as 80 per cent of the amount of permissible explosives used in coal mines is used in bituminous mines, it is interesting to compare Tables 8 and 5, for the former gives the decreased fatality rate and the latter the increased amount of permissible explosives used in and about coal mines. In 1903, 9.8 per cent of the fatalities at bituminous mines were caused by explosives, whereas in 1918 only 4.19 per cent were due to this cause.

Table 9 shows that 9 to 14 per cent of the metal-mine fatalities and 16 to 26 per cent of the quarry fatalities were from explosives.

TABLE 8.—*Fatalities due to explosives at bituminous coal mines, 1903–1918.*

Year.	Number killed.	Percentage of total killed.	Number killed per 1,000 employed.
1903	138	9.80	0.339
1904	121	8.64	.290
1905	119	7.49	.264
1906	115	7.27	.246
1907	134	5.29	.264
1908	109	6.17	.216
1909	122	5.88	.244
1910	113	5.09	.203
1911	72	3.68	.130
1912	70	3.85	.128
1913	63	2.91	.110
1914	56	3.01	.096
1915	76	4.51	.136
1916	60	3.59	.107
1917	56	2.64	.092
1918	85	4.19	.....

TABLE 9.—*Number and percentage of fatalities due to explosives, at metal mines and quarries in the United States.*

Year.	Metal mines.		Quarries.	
	Number.	*Per cent.*	*Number.*	*Per cent.*
1911	78	11.22	50	26.60
1912	94	14.22	47	22.06
1913	89	13.03	44	24.04
1914	60	10.73	35	19.44
1915	78	14.10	28	18.92
1916	89	12.77	28	16.18
1917	79	9.27	21	16.03

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DISTRIBUTION OF EXPLOSIVES BY PRINCIPAL INDUSTRIES.

Table 10 shows the percentages of black blasting powder, high explosives, and permissible explosives used in the various branches of the mining industry. For example, in 1918, 87.7 per cent of the black blasting powder was used in mining coal and only 3 per cent for other mining. In 1918, the mining industry of the United States used 80 per cent of all the explosives produced in this country, as compared with 76.4 per cent in 1917. Of the total amount of permissible explosives used in 1918, 80.9 per cent were used in coal mining and 9.9 per cent for other mining. Of high explosives other than permissible explosives, only a small percentage of the production is used for mining coal, and approximately 50 per cent is used for other mining.

TABLE 10.—*Percentage of explosives used for various purposes in the United States during 1915, 1916, 1917, and 1918.*

	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Total.
1918.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*
Black blasting powder	87.7	3.0	2.2	7.1	100.00
High explosives	15.2	49.6	5.8	29.4	100.00
Permissible explosives	80.9	9.9	.4	8.8	100.00
Total	**57.1**	**22.9**	**3.5**	**16.5**	**100.00**
1917.					
Black blasting powder	85.1	3.4	4.7	6.8	100.0
High explosives	10.8	50.4	7.8	31.0	100.0
Permissible explosives	76.5	14.2	.2	9.1	100.0
Total	**51.0**	**25.4**	**5.7**	**17.9**	**100.0**
1916.					
Black blasting powder	82.1	3.6	5.0	9.3	100.0
High explosives	8.2	51.6	8.6	31.6	100.0
Permissible explosives	76.6	17.9	.3	5.2	100.0
Total	**44.4**	**28.8**	**6.5**	**20.3**	**100.0**
1915.					
Black blasting powder	84.8	3.4	3.6	8.2	100.0
High explosives	9.5	46.3	9.4	34.9	100.1
Permissible explosives	79.9	17.1	.5	2.5	100.0
Total	**45.9**	**26.1**	**6.4**	**21.5**	**99.9**

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EXPORTS OF EXPLOSIVES, 1913–1918.

Table 11 shows the amount of explosives exported from the United States during the years 1913 to 1918, inclusive. In 1913 the total exports of gunpowder were 1,284,422 pounds; in 1918, 232,450,488 pounds. The tabulations of exports unfortunately do not segregate such explosives as picric acid, nitroglycerin, trinitrotoluene, and others. These are grouped in the column headed "All other."

TABLE 11.—*Explosives exported from the United States, 1913–1918.*[a]

	Cartridges.	Dynamite.		Gunpowder.		All other.	Total.
	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Dollars.	Dollars.
Total, 1913	**3,015,399**	**13,399,616**	**1,498,222**	**1,284,422**	**359,855**	**651,601**	**5,525,077**
Total, 1914	**6,567,122**	**11,296,115**	**1,213,600**	**896,569**	**291,453**	**1,965,412**	**10,037,587**
Total, 1915	**25,408,079**	**11,446,368**	**1,509,050**	**84,358,379**	**66,922,807**	**95,129,957**	**188,969,893**
Total, 1916	**55,103,904**	**18,681,285**	**4,173,175**	**303,648,981**	**262,161,893**	**394,136,334**	**715,575,306**
1917 (revised).							
January	5,115,452	1,787,600	380,493	36,767,894	30,567,217	44,965,059	81,028,221
February	4,521,939	2,464,970	462,641	54,269,508	45,944,045	32,257,221	83,185,846
March	4,780,060	1,546,614	300,624	28,004,168	23,104,352	45,597,685	73,782,721
April	6,408,171	505,020	90,067	36,072,072	28,370,522	27,189,079	62,057,839
May	6,802,345	1,450,021	282,833	42,016,169	32,140,788	14,946,392	54,172,358
June	7,095,578	1,687,303	422,094	29,592,425	20,120,734	18,288,732	45,927,138
July	3,440,146	441,604	103,483	28,889,533	22,535,926	6,325,348	32,404,903
August	1,579,789	2,421,830	565,933	40,765,434	29,747,538	22,716,454	54,609,714
September	318,980	1,209,244	333,391	30,075,293	21,817,009	15,289,295	37,758,675
October	908,531	2,243,884	427,977	58,753,162	42,602,791	14,324,794	58,264,093
November	897,122	1,133,437	327,567	14,314,785	11,346,349	10,127,656	22,698,694
December	254,543	1,032,876	255,752	38,938,811	29,607,416	3,926,492	34,044,203
Total	**42,122,656**	**17,924,403**	**3,952,855**	**438,459,254**	**337,904,687**	**255,954,207**	**639,934,405**
1918.							
January	**2,438,334**	**2,606,297**	**764,677**	**47,230,343**	**37,587,662**	**2,992,420**	**43,783,093**
February	**76,811**	**1,886,938**	**477,170**	**22,120,121**	**16,671,446**	**3,533,682**	**20,759,109**
March	**1,139,778**	**1,715,645**	**713,879**	**26,858,306**	**24,235,231**	**2,611,238**	**28,700,126**
April	**2,028,948**	**1,663,368**	**440,646**	**15,924,869**	**12,927,166**	**7,620,916**	**23,017,676**
May	**388,671**	**724,900**	**166,703**	**9,738,388**	**6,800,933**	**4,697,478**	**12,053,785**
June	**200,718**	**1,831,645**	**414,330**	**6,907,838**	**6,322,346**	**3,870,328**	**10,807,722**
July	**1,328,328**	**1,532,963**	**383,389**	**12,017,568**	**9,178,074**	**6,033,998**	**16,923,789**
August	**765,910**	**523,400**	**137,756**	**18,004,450**	**13,279,069**	**3,902,620**	**18,085,355**
September	**199,387**	**2,240,600**	**519,976**	**41,959,721**	**34,667,955**	**6,738,675**	**42,125,993**
October	**1,315,296**	**790,150**	**185,850**	**17,834,972**	**15,662,181**	**4,992,588**	**22,155,915**
November	**271,029**	**1,039,178**	**225,908**	**13,691,014**	**7,260,214**	**475,268**	**8,232,419**
December	**611,555**	**1,649,560**	**415,604**	**162,898**	**71,934**	**795,394**	**1,894,487**
Total	**10,764,765**	**18,204,644**	**4,845,888**	**232,450,488**	**184,664,211**	**48,264,605**	**248,539,469**

[a] Compiled from "Monthly Summary of Foreign Commerce of the United States," published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

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PERMISSIBLE EXPLOSIVES TESTED PRIOR TO MARCH 31, 1919.

By S. P. Howell.

The following table contains the brand name, class designation on the basis of the volume of poisonous gases produced, [a] class designation on the basis of the characteristic ingredient,[b] grade of detonator or electric detonator prescribed, weight of 1¼ by 8 inch cartridge, smallest permissible diameter, unit deflective charge, rate of detonation, and the name of the manufacturer of each of the 160 permissible explosives that had been tested by the Bureau of Mines prior to March 31, 1919.

All of these explosives are subject to the conditions and provisions detailed in Technical Paper 169.[c]

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[a] Class A, 0 to 53 liters, inclusive; class B, more than 53 to 106 liters, inclusive; class C, more than 106 to 158 liters, inclusive.

[b] Class 1, ammonium nitrate; subclass *a*, containing a sensitizer that is in itself an explosive; subclass *b*, containing a sensitizer that is not in itself an explosive; class 2, hydrated; class 3, organic nitrate; class 4, nitroglycerin.

[c] Howell, S. P., Permissible explosives tested prior to Jan. 1, 1917: Tech. Paper 169, Bureau of Mines, 1917, 20 pp.

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Permissible explosives tested prior to March 31, 1919.

Brand.	Class designation basis, volume of poisonous gases.	Class designation basis, characteristic ingredient.	When used with detonators, preferably electric detonators of not less efficiency than—	Weight of 1¼ by 8 inch cartridge.	Smallest permissible diameter.	Unit deflective charge.	Rate of detonation in 1¼ inch diameter cartridges.		Manufacturer.
1	2	3	4	5	6	7	8		9
				Grams.	*Inches.*	*Grams.*	*Feet per second.*	*Meters per second.*	
Aetna coal powder A	C	4	No. 6	184	1¼	277	12,620	3,848	Aetna Explosives Co. (Inc.), New York, N. Y.
Aetna coal powder AA	A	1a	do	a 214	1¼	241	7,880	2,403	Do.
Aetna coal powder B	C	4	do	179	1¼	301	9,870	3,008	Do.
Aetna coal powder C	B	do	do	198	1¼	344	7,010	2,138	Do.
Aetna coal powder 2	A	1a	do	186	1¼	212	9,280	2,830	Do.
Bental coal powder No. 2	A	do	No. 7	180	1¼	276	4,750	1,447	Hercules Powder Co., Wilmington, Del.
Bental coal powder No. 2-X	A	do	No. 6	192	1¼	280	7,980	2,432	Do.
Big Red No. 1	B	do	do	171	⅞	240	7,250	2,209	The Equitable Powder Manufacturing Co. and the Egyptian Powder Co., East Alton, Ill.
Big Red No. 2	B	do	do	166	⅞	255	10,850	3,309	Do.
Big Red No. 4-L. F	B	do	do	171	⅞	254	10,290	3,138	Do.
Big Red No. 5	A	do	do	182	⅞	260	7,490	2,284	Do.
Big Red No. 6-L. F	B	do	do	174	⅞	242	7,480	2,280	Do.
Big Red No. 7	A	do	do	186	⅞	227	10,000	3,050	Do.
Bituminite 1	C	4	do	187	1¼	318	12,800	3,901	Aetna Explosives Co. (Inc.), New York, N. Y.
Bituminite 3	C	do	do	192	1¼	294	9,330	2,843	Do.
Bituminite 4	C	do	do	178	1¼	301	7,540	2,298	Do.
Bituminite 5	A	1a	do	176	1¼	231	9,120	2,782	Do.
Bituminite 8-L. F	C	4	do	155	1¼	303	9,300	2,834	Do.
Black Diamond No. 2-A	C	do	do	190	1¼	281	12,600	3,842	Illinois Powder Manufacturing Co., St. Louis, Mo.
Black Diamond No. 3-A	C	do	do	156	1¼	294	11,160	3,402	Do.
Black Diamond No. 5	A	1a	do	180	1¼	288	6,020	1,835	Do.
Black Diamond No. 6-L. F	C	4	do	158	1¼	306	9,630	2,935	Do.
Black Diamond No. 7	A	1a	do	183	1¼	214	10,730	3,270	Do.
Black Diamond No. 8	B	4	do	168	1¼	295	8,730	2,663	Do.
Cameron mine powder No. 1-A	A	1a	do	156	1¼	227	10,950	3,339	Grasselli Powder Co., Cleveland, Ohio.
Cameron mine powder No. 2-A	A	do	do	a 224	1¼	230	b 10,520	b 3,206	Do.
Cameron mine powder No. 2-A, L. F	A	do	do	215	1¼	233	10,950	3,338	Do.
Cameron mine powder No. 3-A	C	4	do	192	1¼	296	10,930	3,333	Do.
Cameron mine powder No. 5-A	C	do	do	226	1⅛	299	8,900	2,712	Do.
Carbonite No. 1	C	do	do	226	1¼	259	10,950	3,338	E.I.du Pont de Nemours & Co., Wilmington, Del.
Carbonite No. 2	C	do	do	170	1¼	302	11,380	3,470	Do.
Carbonite No. 2-L. F	C	do	do	180	⅞	305	7,830	2,387	Do.
Carbonite No. 3	C	do	do	174	1¼	325	8,710	2,656	Do.
Carbonite No. 4	C	do	do	200	1¼	327	7,670	2,339	Do.

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Carbonite No. 5	C	...do	...do	175	½	304	10,140	3,092	Do.
Carbonite No. 6	C	...do	...do	175	½	345	7,490	2,285	Do.
Coalite X	A	1a	...do	156	1½	226	9,000	2,745	Atlas Powder Co., Wilmington, Del.
Coalite Y	B	...do	...do	164	½	235	10,300	3,141	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Coalite No. 1	C	4	...do	232	1½	296	7,930	2,418	Do.
Coalite No. 2-D	B	...do	...do	233	1½	310	8,430	2,571	Do.
Coalite No. 2-D. L	C	...do	...do	146	1½	271	7,340	2,237	Do.
Coalite No. 2-M. L. F	C	...do	...do	157	1½	301	9,220	2,811	Do.
Coalite No. 3-XC	B	1a	...do	164	1½	250	8,320	2,536	Atlas Powder Co., Wilmington, Del.
Coalite No. 3-YC	B	...do	...do	162	½	250	9,670	2,940	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Coal special 1	B	4	...do	214	1½	288	11,800	3,598	Aetna Explosives Co. (Inc.), New York, N. Y.
Coal special 1-A	C	...do	...do	148	1½	276	9,370	2,857	Do.
Coal special 1-L. F	C	...do	...do	150	1½	277	8,280	2,524	Do.
Coal special 2	C	...do	...do	201	1½	304	10,240	3,123	Do.
Coal special 2-W	C	...do	...do	180	1½	277	11,590	3,534	Do.
Coal special 3-C	C	...do	...do	192	1½	288	9,760	2,977	Do.
Collier B, N. F	B	1a	...do	176	1½	224	10,950	3,338	Do.
Collier KN	A	...do	...do	175	1½	222	11,610	3,539	Do.
Collier X	A	...do	...do	192	1½	273	7,820	2,384	Do.
Collier Y	A	...do	...do	172	1½	229	9,740	2,970	Do.
Collier X, I. F. 1	B	1a	...do	164	½	237	8,140	2,483	Do.
Collier X, L. F	A	...do	...do	196	1½	252	9,990	3,047	Do.
Collier 2	C	4	...do	146	1½	300	8,870	2,704	Do.
Collier 5	A	1a	...do	178	1½	240	8,280	2,524	Do.
Collier 5-L. F	A	...do	...do	186	1½	232	9,370	2,858	Do.
Collier 5, special	A	...do	...do	180	1½	236	8,330	2,541	Do.
Collier 6	A	...do	...do	169	½	214	11,220	3,422	Do.
Collier 6-L. F	C	4	...do	174	1½	317	9,660	2,944	Do.
Collier 9	B	1a	...do	197	1½	283	6,690	2,040	Do.
Collier 11	A	...do	...do	165	1½	217	11,680	3,561	Do.
Collier 11-L. F	B	...do	...do	180	1½	226	10,850	3,307	Do.
Cronite No. 1	A	...do	...do	149	1½	233	10,490	3,198	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Cronite No. 5	B	...do	No. 7	165	1½	249	8,090	2,466	Do.
du Pont Lump-Coal Powder No. 1	A	4	No. 6	185	1½	382	5,200	1,586	E.I.du Pont de Nemours & Co., Wilmington, Del.
du Pont Permissible No. 1	B	1a	...do	175	½	278	9,610	2,930	Do.
Eureka No. 2	B	2	...do	190	1½	311	10,720	3,269	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Franklinite 1	C	4	...do	192	1½	288	9,760	2,977	Aetna Explosives Co. (Inc.), New York, N. Y.
Franklinite 2	C	...do	...do	146	1½	300	8,870	2,704	Do.
Franklinite 3	C	...do	...do	201	1½	304	10,240	3,123	Do.
Franklinite 4	B	...do	...do	198	1½	344	7,010	2,138	Do.
Franklinite 5	A	1a	...do	186	1½	232	9,370	2,858	Do.
Franklinite 6	A	...do	...do	196	1½	252	9,990	3,047	Do.
Fuel-ite No. 3	B	...do	...do	179	1½	215	8,590	2,620	Grasselli Powder Co., Cleveland, Ohio.
Fuel-ite No. 3-L. F	B	...do	...do	172	1½	229	10,810	3,296	Do.
General Coal Powder B	C	4	...do	187	1½	299	10,640	3,244	General Explosives Co., Joplin, Mo.
Giant coal-mine powder No. 5	B	1a	...do	157	1½	228	10,230	3,118	Giant Powder Co. (Con.), Giant, Cal.
Guardian No. 2	A	...do	...do	202	1½	245	8,980	2,738	Hercules Powder Co., Wilmington, Del.
Guardian No. 2-X	A	...do	...do	204	1½	245	7,990	2,437	Do.
Guardian No. 3	B	...do	...do	186	1½	272	7,660	2,336	Do.

[a] 1½-inch by 8-inch cartridge.

[b] 1½-inch diameter cartridges.

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Permissible explosives tested prior to March 31, 1919—Continued.

Brand.	Class designation basis, volume of poisonous gases.	Class designation basis, characteristic ingredient.	When used with detonators, preferably electric detonators of not less efficiency than—	Weight of 1¼ by 8 inch cartridge.	Smallest permissible diameter.	Unit deflective charge.	Rate of detonation in 1¼-inch diameter cartridges.		Manufacturer.
1	2	3	4	5	6	7	8		9
				Grams.	*Inches.*	*Grams.*	*Feet per second.*	*Meters per second.*	
Guardian No. 3-X	A	1a	No. 6	183	1¼	252	8,470	2,582	Hercules Powder Co., Wilmington, Del.
Hecla No. 2	A	do	No. 7	188	1¼	253	13,990	4,264	E. I. du Pont de Nemours & Co., Wilmington, Del.
Hygrade coal powder No. 2	B	4	No. 6	232	1¼	329	8,450	2,576	Hygrade Powder Co., Philadelphia, Pa.
Kanite A	A	1b	No. 8	a 319	1¾	255	b 10,730	b 3,270	W. H. Blumenstein Chemical Works, Pottsville, Pa.
King No. 2-A c	C	4	No. 6	190	1¼	281	12,600	3,842	The King Powder Co., Cincinnati, Ohio.
King No. 3-A c	C	do	do	156	1¼	294	11,160	3,402	Do.
King No. 5 c	A	1a	do	180	1¼	288	6,020	1,835	Do.
King No. 6-L. F. c	C	4	do	158	1¼	306	9,630	2,935	Do.
King No. 7 c	A	1a	do	183	1¼	214	10,730	3,270	Do.
King No. 8 c	B	4	do	168	1¼	295	8,730	2,663	Do.
Little Red No. 2	B	do	do	185	⅞	321	9,300	2,836	The Equitable Powder Manufacturing Co. and the Egyptian Powder Co., East Alton, Ill.
Little Red No. 3	C	do	do	163	⅞	325	7,940	2,421	Do.
Little Red No. 4	B	do	do	193	⅞	349	8,100	2,469	Do.
Little Red No. 5-L. F	B	do	do	177	⅞	300	11,110	3,387	Do.
Little Red No. 6-L. F	B	do	do	168	⅞	333	7,650	2,331	Do.
Lomite No. 1	B	2	do	176	1¼	300	13,940	4,250	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Lowinite No. 2-B	A	1a	do	148	1¼	258	9,740	2,971	Lowinite Explosives Manufacturing Co., Pittsburgh, Pa.
Meteor AXXO	A	2	do	265	1¼	434	8,410	2,563	E. I. du Pont de Nemours & Co., Wilmington, Del.
Mine-ite A	B	4	do	183	1¼	296	11,290	3,443	Grasselli Powder Co., Cleveland, Ohio.
Mine-ite A-2	C	do	do	156	1¼	319	10,670	3,252	Do.
Mine-ite B	C	do	do	168	1¼	340	9,540	2,908	Do.
Mine-ite No. 5-D	A	1a	do	161	1¼	241	8,720	2,658	Do.
Mine-ite No. 6-D	B	do	do	169	1¼	224	8,090	2,467	Do.
Miners Friend No. 1	B	do	do	182	⅞	233	11,580	3,529	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Miners Friend No. 2	B	do	do	182	⅞	260	10,330	3,149	Do.
Miners Friend No. 3	B	do	do	174	⅞	252	8,030	2,449	Do.
Miners Friend No. 4	B	do	do	179	⅞	261	9,980	3,044	Do.
Miners Friend No. 5	B	do	do	190	⅞	250	8,570	2,614	Do.
Miners Friend No. 6	B	do	do	167	⅞	234	10,900	3,324	Do.

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Miners Friend No. 7	A	do	do	176	⅞	253	8,950	2,729	Do.
Miners Friend No. 8–L. F	A	4	do	193	1¼	421	4,650	1,417	Do.
Monobel No. 1	B	1a	do	179	1⅛	216	11,700	3,568	E. I. du Pont de Nemours & Co., Wilmington, Del.
Monobel No. 2	B	do	do	178	⅞	239	9,870	3,009	Do.
Monobel No. 3	B	do	do	174	⅞	243	7,260	2,212	Do.
Monobel No. 4	B	do	do	174	⅞	248	8,980	2,738	Do.
Monobel No. 5	B	do	do	179	1	267	6,760	2,061	Do.
Monobel No. 6	B	do	do	175	⅞	218	10,380	3,165	Do.
Monobel No. 7	B	do	do	180	⅞	211	10,050	3,065	Do.
Nitro low-flame No. 1	C	4	do	234	1¼	303	13,380	4,079	Nitro Powder Co., Kingston, N. Y.
Nitro low-flame No. 2	C	do	do	226	1¼	298	14,560	4,439	Do.
Red H No. 1	B	1a	do	167	1⅛	216	11,700	3,568	Hercules Powder Co., Wilmington, Del.
Red H No. 2	B	do	do	160	⅞	239	9,870	3,009	Do.
Red H No. 3	B	do	do	173	⅞	243	7,260	2,212	Do.
Red H No. 4	B	do	do	164	⅞	248	8,980	2,738	Do.
Red H No. 5	B	do	do	170	1	267	6,760	2,061	Do.
Red H No. 6	B	do	do	162	⅞	218	10,380	3,165	Do.
Red H No. 7	B	do	do	180	⅞	211	10,050	3,065	Do.
Red H No. 8	B	do	do	164	⅞	278	7,590	2,315	Do.
Trojan coal powder H	A	3	do	218	1¼	394	9,420	2,872	Pennsylvania Trojan Powder Co., Allentown, Pa.
Trojan coal powder I	A	do	do	218	1¼	410	9,620	2,934	Do.
Trojan coal powder J	A	do	do	229	1¼	360	10,590	3,230	Do.
Trojan coal powder K	B	do	do	181	1¼	314	10,380	3,164	Do.
Trojan coal powder L	B	do	do	166	1⅛	275	10,560	3,221	Do.
Trojan granular coal powder No. 1	A	do	do	[d] 247	1⅝	265	[e] 7,920	[e] 2,416	Do.
Tunnelite AA	A	1a	do	176	1⅛	253	7,690	2,346	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Tunnelite B	B	do	do	167	1⅛	249	9,990	3,047	Do.
Tunnelite C	A	do	do	187	1⅛	255	10,060	3,068	Do.
Tunnelite No. 3	C	4	do	150	1⅛	291	10,110	3,083	Do.
Tunnelite No. 4	C	do	do	136	1⅛	309	10,620	3,238	Do.
Tunnelite No. 5	C	do	do	176	1¼	328	8,400	2,562	Do.
Tunnelite No. 6	C	do	do	172	1¼	305	9,670	2,947	Do.
Tunnelite No. 6–L. F	C	do	do	156	1¼	301	9,620	2,933	Do.
Tunnelite No. 7	C	do	do	164	1¼	311	8,720	2,659	Do.
Tunnelite No. 8	C	do	do	158	1¼	324	8,020	2,446	Do.
Tunnelite No. 8–L. F	C	do	do	176	1¼	322	8,720	2,658	Do.
Vigorite No. 1	C	do	do	204	1¼	259	10,950	3,338	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Vigorite No. 2	C	do	do	168	⅞	298	10,920	3,330	Do.
Vigorite No. 3	B	do	do	160	⅞	320	8,140	2,483	Do.
Vigorite No. 4	B	do	do	186	⅞	341	7,480	2,281	Do.
Vigorite No. 5	C	do	do	156	⅞	308	10,830	3,303	Do.
Vigorite No. 6	C	do	do	166	⅞	345	7,490	2,285	Do.
Xpdite No. 1	C	do	do	211	1¼	259	10,950	3,338	Hercules Powder Co., Wilmington, Del.
Xpdite No. 2	C	do	do	168	1¼	302	11,380	3,470	Do.
Xpdite No. 3	C	do	do	162	1¼	325	8,710	2,656	Do.
Xpdite No. 4	C	do	do	190	1¼	327	7,670	2,339	Do.
Xpdite No. 5	C	do	do	166	⅞	304	10,140	3,092	Do.
Xpdite No. 6	C	do	do	165	⅞	345	7,490	2,285	Do.

[a] 1¾ by 8 inch cartridge. [b] 1⅜-inch diameter cartridges. [c] Same as the corresponding brands of the Black Diamonds, p. 16. [d] 1⅝ by 8 inch cartridge. [e] 1¼-inch diameter cartridges.

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